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Open Ocean Test of Precision Microwave Aircraft Instrument for Ocean Salinity Remote Sensing

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ABSTRACT

There has been a growing awareness among researchers of the important role that ocean surface salinity variability plays in ocean and climate dynamics. This has prompted a general call for increased salinity observations within the evolving climate research programs. JPL has developed an aircraft instrument to provide accurate active and passive measurements of the ocean surface to improve existing radiative transfer and backscatter models. This instrument will also be used to develop improved algorithms for salinity measurements and for testing and validation of future space instruments.

Based on simulations of radiometer and radar measurements, it is possible to determine the required instrument configuration and calibration requirements to measure ocean salinity to the accuracy required of 0.2 PSU over the open ocean. This new instrument has dual-frequency (L- and S-band), dual polarization radiometer and radar sensors. The antenna is a high beam efficiency conical horn pointed at a 45-degree incidence angle to the ocean surface. The low frequency radiometers are sensitive to the changes in the ocean surface emissivity due to changes in the salinity, and the radar backscatter measurements are used to correct for the surface roughness from the wind and waves. An IR sensor was used to correct for changes in the sea surface temperature. Because the L-band brightness temperature salinity signal is so small, e.g. a salinity accuracy of 0.2 PSU requires a noise sensitivity of < 0.1 K, the radiometer system was built with a noise diode calibration source to provide radiometer stability < 0.1 K over relevant measurement times.

This Passive Active L/S (PALS) instrument was installed on the NSF NCAR C-130 aircraft and salinity measurement missions were flown on July 17-19, 1999, south of Norfolk, Virginia over the Gulf stream. The Cape Hatteras ship from Duke University provided ocean truth on the salinity, temperature and wind. The measurements were very successful, and a clear salinity signal was measured repeatedly during these three days, which was in good agreement with the Cape Hatteras salinity data.